Soldering Surface-Mount Devices

Dino Papas, KL0S

You can successfully build ham radio projects that use surface-mount devices (SMDs) with proper circuit board preparation and the right tools. My wife, Toby, KL0SS, and I won a banquet prize of two kits that were donated by Kanga Products, a supplier of do-it-yourself projects. One was a 30-meter CW low-power transceiver, and the other an SMD 50 Ω dummy load capable of dissipating up to 5 W. I thought the dummy load kit was a great candidate to install in my restored Heathkit HW-8 low-power transceiver as an internal load for transmitter tuning before connecting to an antenna.

The load consists of 40 parallel-connected 2 kΩ resistors, creating a 50 Ω load. The final measured resistance for my completed load is 50.09 Ω. A small additional diode detector circuit allows you to measure the rms voltage across the load so you can calculate the applied power. Figure 1 shows the first row of resistors installed at the top of the board, along with 10 SMD resistors shown above the board. All that is left is assembly.

How to solder SMD components using a pair of soldering irons.

Tools

I have done SMD work before, so I looked forward to this challenge. Solder flux is one of the keys to any soldering job, and more so with SMD components. Flux comes in either a liquid or paste form, but liquid flux has a much longer shelf life. Another key tool is a good pair of tweezers with very sharp points for moving the parts around.

A big challenge to working with SMD parts is being able to see what you're doing with the small parts. I use the Carson Pro "Magnivisor Deluxe" Model CP-60 (see the lead image) that I bought for less than $30 on **amazon.com**. The unit has four interchangeable magnifying lenses — 1.5×, 2×, 2.5×, and 3× — and includes a very bright, adjustable LED lamp attached to the headband. You can wear your eyeglasses while you're using it and the visor allows you to flip the lens up out of the way when you're not actually soldering.

Placing Parts and Soldering

Everyone has their favorite method of getting the SMD parts into place and holding them there while soldering the parts to the board. What I do is dab a bit of liquid flux onto the board solder pads, add just a hint of solder to one pad, and then use my tweezers to move the part into place. Once I'm satisfied with the orientation, I use a sharp pick tool to hold the component down and temporarily tack-solder that pin to the pad on the board to which I'd added solder. Then, I remove the pick and solder the other pin.

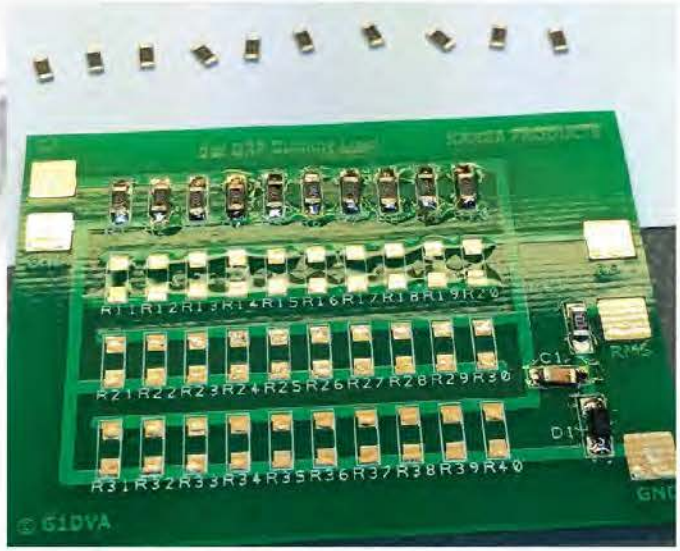

Figure 1 — The first row of resistors are installed at the top of the board. Another 10 SMD resistors are shown above the board. [Dino Papas, KL0S, photo]

Figure 2 — The Weller model WM120 Mini Iron is on the left, and the model WES51 soldering station is on the right. [Dino Papas, KL0S, photo]

Afterwards, I return to the first pin and re-solder the connection.

For general soldering, I use a Weller WES51 soldering station (on the right in Figure 2), but even the smallest tip available for that iron can make it tough to solder SMD-size connections correctly without creating solder bridges. For really fine work, I like to use my smaller Weller model WM120 Mini Iron (on the left in Figure 2), which has a very fine tip. You can see similar tips compared in Figure 3.

Keeping the soldering iron tip clean and properly tinned goes a long way to making good solder connections. With the number of resistors in this project and their proximity to one another, and because I have a soldering iron with a suitable tip, I decided it was quicker to do the project this way than it would be using my hot-air rework station for soldering.

Figure 3 — The Mini Iron pencil tip (right) is preferred over a flat, wide soldering station tip (left). [Paul Cianciolo, W1VLF, photo]

Don't let projects with SMD parts scare you away. With a little practice, you can build some really cool ham radio projects.

Amateur Extra-class licensee and ARRL Life Member Dino Papas, KL0S, has been an Amateur Radio operator for almost 50 years. He holds a BSEE degree from the University of California at Davis and a Master's in engineering management from George Washington University. Dino retired as a colonel after 26 years of active duty in the US Army. He now resides with his wife Toby, KL0SS, a retired Army lieutenant colonel and ARRL Life Member, in Williamsburg, Virginia. He is president of the Williamsburg Area Amateur Radio Club. Dino and Toby host the club's Builders Group, a regular meeting of hams to homebrew together that was described in "Ham Radio Makerspace" in the February 2015 issue of *QST*. You can contact Dino at **kl0s@arrl.net**.

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